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SCIENCE.

FRIDAY, SEPTEMBER 7, 1883.

FRANCIS MAITLAND BALFOUR.

ABOUT a year ago came the sad news of the sudden death of Professor Balfour of Cambridge. If the loss was felt less severely in this country than in England, it was only because he had fewer personal friends here; and to fully understand his worth one must have known and talked with him. It is true that it required no unusual insight to read the fine qualities of the man in his writings; but none save those who knew him could appreciate his remarkable personal attractiveness. Not the least part of the wonderful work of his short life was that which he accomplished as a teacher: here as everywhere, his personal influence had a large share; and a sketch of Balfour's scientific work would be incomplete without a recognition of the bearing which his noble character had upon it.

The meeting of leading biologists in Octo-

ber last, to found the Memorial studentship, was remarkable in many ways: rarely have been heard such words of admiration and love for one man as were then expressed for Balfour. Many spoke at length of the debt Cam-

bridge owed him.

It may be said that he divided with Foster the honor of giving the great impetus to the biological movement in the English universities. What Huxley had done for Foster, the latter did for Balfour, giving him the first hearty encouragement and support; together they raised biology from the third to the level of the first rank of studies at Cambridge, equalling that held by mathematics. Oxford soon followed this important movement, trying to secure Balfour for the professorship left vacant by the death of Rolleston. His connection with natural science at Cambridge was



Francis Maitland Balfour

described in warm language by Foster, his teacher, and by Sedgwick, one of his pupils: he advanced morphology there by his brilliant success in teaching and in research.

In teaching he combined manly force with a delicate regard for the feelings of his pupils. From the writer's personal impressions of him as a lecturer, he did not aim at eloquence, but to be understood in every step; rarely looking at his hearers, he spoke rapidly and with intense earnestness, crowding a vast deal into the hour. The main qualities of his character shone forth in his lectures, — energy, which he infused into his hearers; truthfulness, which soon gave implicit confidence in his statements; modesty and sympathy, which inspired effort and free exchange of thought.

Balfour's love of truth came constantly into play in his laboratory instruction. While looking over a student's shoulder, he would sometimes say with a laugh, "You must interpret that specimen with the eye of faith;" but this was very far from being a serious injunction, for he exacted of his students the greatest caution in the progress of their microscopic work. However tempting a certain interpretation of a specimen might be, Balfour never accepted it until it rested on the clearest evidence. An instance of this sort is recalled by the writer, which related to the much disputed origin of a well-known embryonic structure. A number of sections had been prepared, seeming to confirm the view which Balfour himself had advocated some time before; it required considerable self-control not to attach a somewhat forced meaning to them: this was, however, forbidden; and it was not until several days afterwards that fresh sections established the fact beyond question.

To Foster, Balfour repaid his student-debt by extending, in turn, continued encouragement to others. He did not fear, as many great teachers have, that joint labor with his juniors would derogate from his reputation: his joint articles are numerous; he was zealous to recognize research done by his pupils, seeming to be prouder of this than of his own work. Nothing could be more stimulating to the young men about him, still distrustful of their powers, than this generous co-operation. Is it surprising, then, that the voluntary attend-

ance upon his lectures increased in seven years from ten to ninety, and that at the time of his death twenty students were engaged in difficult research in his laboratory? Only those who are familiar by experience with the few incentives among younger students to the study of biology can appreciate what these numbers mean.

We need not attempt to give a full list of Balfour's writings. They began in 1873, his twenty-first year, with a few short papers appearing over Foster's name and his own in the *Quarterly journal of microscopical science*: they terminated nine years later, with his fine work upon *Peripatus*, published posthumously in the same journal, and of which a full abstract will be found farther on. His extensive intermediate works, the *Elasmobranch fishes* and *Comparative embryology*, are universally known.

From the first he devoted himself to embryology. While this, as among the youngest of the biological sciences, admits of rapid work, it is far from admitting rapid generalization. No other branch of morphology requires more painstaking; the very materials one has to study are minute and indefinite; and two minds will often place different constructions upon the same specimen. There is abundant opportunity for scientific guesswork, with the feeling of security that disproof will be difficult. Balfour understood the real value of guessing at truth, but he always made it very clear to the reader when he was so doing; his hypotheses were accompanied by definite statements, in which the reasons *pro* and *con* were set forth in all impartiality to each. Herein lies a chief charm and merit of his work, its brilliant suggestiveness, side by side but never in confusion with well-established facts. Every chapter contains half a dozen invitations to other investigators to prove or disprove certain provisional statements. Vast as is the information contained in his *Comparative embryology*, Balfour himself appreciated, that, as far as mere facts went, the first volume would be somewhat out of date before the second was in press. Not so, however,

with his masterly discussions of these facts, which are found on every page, and the value of which, to embryologists, cannot be estimated. Moreover, to his authorship is largely due the rapidly spreading interest in embryology in England and America, — a branch of science, it will be remembered, which had previously been mostly in German hands.

One frequently heard from him his own very modest opinion of his work; this was not at all inconsistent with striking independence and originality of thought, and adherence to his convictions. His modesty added more to the recognition of his genius than any assertions of his own could have done. Many were pressing forward to assert his claims, and honors were fast showered upon him in England and abroad. He was admired and beloved by all who knew him. In scientific discussion he had the rare quality, which Richard Cobden is said to have possessed, of remaining on the pleasantest personal terms with his opponents.

His energy in all matters was great, and his power of writing was unusually rapid; but, advised by kind friends, he rarely overtaxed his strength, which was limited. He spent most of his evenings with his friends, throwing off from his mind the labors of the day, and talking vivaciously upon the topics of the times. When the first volume of *Comparative embryology* was being written, he generally worked but five hours daily, giving much time to physical exercise, bicycling, or tennis, into which he entered with all the enthusiasm of his nature. He was courageous, but not reckless; and nothing in his previous life would lead us to suppose that the mountain climb which proved fatal was undertaken in a foolhardy spirit.

Balfour in a few years accomplished the work of a lifetime. His influence was and is twofold, — first, upon those with whom he came in personal contact, especially his scientific associates and students (an influence which cannot fail to endure, well expressed by Professor Kitchen Parker: "I feel that his presence is still with me; I cannot lose the sense of his

presence"); and, secondly, the influence of his scientific work, which for genius, breadth, and truth, can never be surpassed. May the splendid memorial which has been raised for him perpetuate his noble example as a teacher and man of science! HENRY F. OSBORN.

THE INTELLIGENCE OF BIRDS.

HAVING met with many instances wherein birds have shown considerable ingenuity in overcoming the ill results of accidents to their nests, such as often arise during violent storms, it occurred to me, at the outset of the bird-nesting season of the present year, to endeavor to test their intellectual powers generally, by a series of simple experiments, hoping thereby to be able to determine to what extent birds exercise their reasoning faculties.

My experiments, and the inferences I drew, are as follows:—

Noting the material being gathered for the nest, partially constructed, of a chipping-sparrow (*Spizella socialis*), I placed a small quantity of the same in a conspicuous position near the nest. It was seen by the sparrows, and examined, but none was removed. I placed a portion of it upon the margin of the unfinished nest: it was promptly removed by the male bird, who used only such materials as were brought to him by his mate. The following day the task of lining the nest with hair was commenced. I placed a quantity of this material on a branch near by, but it was passed unnoticed. I next placed a few hairs on the margin of the nest: they were promptly removed. On replacing many of these in the nest, the entire lining was thrown out. I replaced it, and the nest was abandoned.

A week later, finding another nest with three eggs, I added a few white cat-hairs to the lining: these were removed. Others of dark colors were added: they, also, were removed. I replaced both dark and white hairs: the eggs were broken, and the nest abandoned.

Four eggs found in a third nest were removed without touching the nest, a wooden spoon whittled for the purpose being used. In three days the female commenced laying again: four days later three eggs had been laid. Replaced the four I had removed: they were promptly thrown from the nest. I then removed the nest, and, substituting another, carefully replaced the eggs without handling them. After what appeared to be a serious consultation, the new nest was accepted.